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(54) **Method for forming curable decal**

(57) The method is suitable for decorating a ceramic article, and comprises printing a liquid material on to a backing paper by an ink jet printer to form a required pattern of adhesive material, supplying particulate decorative material such as pigment on to the adhesive pattern, and subsequently removing excess particulate material. The liquid material may be an adhesive, or alternatively the liquid material may comprise a solvent which activates an adhesive material on the backing paper.

DECORATIVE METHOD AND MATERIALS

This invention relates to decorative methods and materials; and particularly but not exclusively curable and especially firable decals for decorating ceramic articles and a method of making such decals; and a method of decorating firable ceramic articles.

Conventionally decals for decorating ceramic articles can be made using offset or screen printing. In offset printing a solvent based adhesive layer is printed by this method on to the backing paper from a roller. Powdered pigment is then supplied onto the adhesive and excess powder subsequently removed, by for example shaking. A number of such layers can be applied sequentially to build up different colours into a sophisticated design. Subsequently a cover coat is applied.

This method has disadvantages in that it is not suitable for printing short runs, due to the cost of forming the rollers. Furthermore, very long drying times can occur for each layer of adhesive.

As an alternative, decals can be made by silk screening liquid inks. The disadvantage with this technique is that it does not provide a high quality definition, i.e. tonal range of colours.

This invention relates to curable decals. Such decals comprise one or more materials which require curing to provide a final decoration. The curing usually takes place after the decal has been applied to an article to be decorated. The curing conventionally occurs during firing. However in some instances the curing may be effected by other means, such as for example UV irradiation, or by using an electron beam.

According to the present invention there is provided a method of forming a curable decal, the method comprising printing a liquid material on to a backing paper by an ink jet printer to form a required pattern of an adhesive material, supplying particulate decorative material on to the adhesive pattern, and removing excess particulate material which has not adhered to the pattern.

A plurality of different particulate materials may be sequentially adhered on to the paper, each subsequent to formation of a respective adhesive pattern.

A cover coat is preferably applied over the particulate material or materials.

The liquid material may comprise an adhesive material. The liquid material is preferably aqueous

based.

A further adhesive material may be provided on the backing paper to permit release therefrom before application to an article.

Alternatively, the liquid material may actuate adhesive material on the backing paper. The liquid material may contain water and the adhesive material may be moisture actuatable.

The adhesive material may comprise dextrin.

A soluble salt may be provided in the liquid material, and the salt may comprise ammonium chloride.

A viscosity increasing additive may be provided in the liquid material, and the additive may comprise any of glycerine, glycerol, ethylene glycol, or polymers thereof.

A humectant may be provided in the liquid material to delay drying time, and the humectant may comprise sorbitol.

A film forming material may be provided in the liquid material which may form up to 10% by weight of

the liquid material. The film forming material may comprise an acrylic or vinyl emulsion system.

The particulate material preferably comprises a pigment, or a pigment plus flux. The pigment may be coated, with for example any of quaternary amine salts, linseed oil, any other synthetic oil, or polymer resin.

The backing paper may be coated with dextrin, or another water soluble gum and a material such as for example rosin may be provided on the backing paper to provide a suitable surface for printing.

The excess particulate material may be removed by dusting and/or compressed air.

The decal is preferably firable.

The invention also provides a curable decal made by a method according to any of the preceding fifteen paragraphs.

The invention also provides a method of providing a decoration on a curable article, the method comprising printing a liquid material by an ink jet printer on to the article to form a required pattern of an adhesive material, supplying particulate decorative material on

to the adhesive pattern, and removing excess particulate material which has not adhered to the pattern.

The method may also be according to any of said preceding fifteen paragraphs.

An embodiment of the present invention will now be described by way of example only.

A firable ceramic decal is formed by taking a backing paper with a coating of dextrin. An aqueous printing medium is sprayed on to the paper by an ink jet printer to actuate the dextrin in a required pattern. The printing medium comprises 500ml of deionised water with 5g of ammonium chloride to raise the conductivity of the medium to permit high quality ink jet print performance. An additive comprising 10g of glycerine is provided to increase the viscosity of the medium to 2cps. A humectant in the form of 5g of sorbitol is provided to delay the drying time of the actuated dextrin.

A suitable coloured pigment or pigment plus flux is sprinkled on to the paper to adhere to the actuated dextrin. Excess pigment is removed from the paper by dusting and/or compressed air. Subsequent pigments may be applied in a similar manner to build up a required

pattern. A cover coat of a suitable type, e.g. methacrylate based, is then applied over the pigments.

The above example is by way of illustration only, and various modifications may be made without departing from the scope of the invention. For example, different salts could be added to raise the conductivity. The viscosity increasing additive could comprise another material such as glycerol, ethylene glycol, or their polymers. Different humectants may be used and these may not be necessary if a different adhesive is used.

The backing paper may as is conventional be covered with dextrin or another water soluble gum. The backing paper may also be overlaid with an extra material such as for example a rosin, to provide a suitable surface for rosin.

Coatings may be provided on the pigments to set the pigment particles into a coherent layer, prior to removal of excess pigment. Such coatings may comprise any of quaternary amine salts, linseed oil, any other synthetic oil, or polymer resin.

In an alternative embodiment, adhesive may be sprayed by the ink jet printer on to the backing paper. The adhesive may be aqueous based, and spraying adhesive

is particularly suited for building up multiple layers of pigment.

As a further alternative, the above described methods for forming a decal may be used to form a decoration directly on to an article of ware. In this instance, the liquid medium is printed direct on to the article of ware. The liquid medium acts as an adhesive or actuates an adhesive on the ware. Obviously where the liquid medium actuates an adhesive, an adhesive layer will have first been applied to the article of ware.

There are thus described methods for forming decals and also for directly decorating an article of ware which provide considerable advantages. Using an ink jet printer enables the operation to be suited for long or short runs and even permits individual designs to be printed, which may be particularly useful when for example applying an individual bar code or other distinct identification to each individual article of ware. Using this type of printing removes the need for producing contoured rollers or other types of printing plate. The liquid medium applied by the ink jet printer dries much more quickly than that applied by other methods, thus greatly reducing the waiting time between applications of different layers.

In all of the above described illustrations, the decals for example are curable by firing. However the invention is equally applicable where curing is effected by different means such as UV irradiation or using an electron beam.

Whilst endeavouring in the foregoing specification to draw attention to those features of the invention believed to be of particular importance it should be understood that the Applicant claims protection in respect of any patentable feature or combination of features hereinbefore referred to and/or shown in the drawings whether or not particular emphasis has been placed thereon.

Claims:-

1. A method of forming a curable decal, the method comprising printing a liquid material on to a backing paper by an ink jet printer to form a required pattern of an adhesive material, supplying particulate decorative material on to the adhesive pattern, and removing excess particulate material which has not adhered to the pattern.
2. A method according to claim 1, in which a plurality of different particulate materials are sequentially adhered on to the paper, each subsequent to formation of a respective adhesive pattern.
3. A method according to claims 1 or 2, in which a cover coat is applied over the particulate material or materials.
4. A method according to any of the preceding claims, in which the liquid material comprises an adhesive material.
5. A method according to claim 4, in which the liquid material is aqueous based.

6. A method according to claims 4 or 5, in which a further adhesive material is provided on the backing paper to permit release therefrom before application to an article.

7. A method according to claims 1 to 3, in which the liquid material actuates adhesive material on the backing paper.

8. A method according to claim 7, in which the liquid material contains water.

9. A method according to claim 8, in which the adhesive material is moisture actuatable.

10. A method according to any of claims 7 to 9, in which the adhesive material comprises dextrin.

11. A method according to any of the preceding claims, in which a soluble salt is provided in the liquid material.

12. A method according to claim 11, in which the salt comprises ammonium chloride.

13. A method according to any of the preceding claims, in which a viscosity increasing additive is provided in

the liquid material.

14. A method according to claim 13, in which the additive comprises any of glycerine, glycerol, ethylene glycol, or polymers thereof.

15. A method according to any of the preceding claims, in which a humectant is provided in the liquid material to delay drying time.

16. A method according to claim 15, in which the humectant comprises sorbitol.

17. A method according to any of the preceding claims, in which a film forming material is provided in the liquid material.

18. A method according to claim 17, in which the liquid material forms up to 10% by weight of the liquid material.

19. A method according to claims 17 or 18, in which the film forming material comprises an acrylic or vinyl emulsion system.

20. A method according to any of the preceding claims, in which the particulate material comprises a pigment,

or a pigment plus flux.

21. A method according to claim 20, in which the pigment is coated, with any of quaternary amine salts, linseed oil, or any other synthetic oil, or polymer resin.
22. A method according to any of the preceding claims, in which the backing paper is coated with water soluble gum.
23. A method according to claim 22, in which the backing paper is coated with dextrin.
24. A method according to any of the preceding claims, in which a material is provided on the backing paper to provide a suitable surface for printing.
25. A method according to claim 24, in which rosin is provided on the backing paper to provide a suitable surface for printing.
26. A method according to any of the preceding claims, in which the excess particulate material is removed by dusting and/or compressed air.
27. A method according to any of the preceding claims,

in which the decal is firable.

28. A curable decal made by a method according to any of claims 1 to 27.

29. A method of providing a decoration on a curable article, the method comprising printing a liquid material by an ink jet printer on to the article to form a required pattern of an adhesive material, supplying particulate decorative material on to the adhesive pattern, and removing excess particulate material which has not adhered to the pattern.

30. A method of forming a curable decal substantially as hereinbefore described.

31. A curable decal substantially as hereinbefore described.

32. A method of providing a decoration on a curable article substantially as hereinbefore described.

33. Any novel subject matter or combination including novel subject matter disclosed in the foregoing specification or claims and/or shown in the drawings, whether or not within the scope of or relating to the same invention as any of the preceding claims.

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(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

Documents considered relevant following a search in respect of Claims :-
1-32

(ii) **ONLINE DATABASE: WPI**

X:	Document indicating lack of novelty or of inventive step.	P:	Document published on or after the declared priority date but before the filing date of the present application.
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A:	Document indicating technological background and/or state of the art.	&:	Member of the same patent family; corresponding document.

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